REMARKS

Reconsideration of this application is respectfully requested in view of the foregoing amendment and the following remarks.

Claims 17-31 were pending in this application. In the Office Action, claims 17-31 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 6,208,136 to Smith et al. ("Smith") and the specification was objected to as having a redundant paragraph at page 16. In this Amendment, the redundant paragraph has been deleted, claims 17-31 have been canceled, and claims 32-46 have been added. No new matter has been added.

Each of the newly added claims includes substantially similar subject matter as was presented for examination in the claims of the Preliminary Amendment filed December 20, 2004. Each of the newly added independent claims further includes features relating to the minimization of intensity variations due to a sample having unknown temperature. For at least this reason and the further reasons provided below, Applicant respectfully submits that all claims are patentable over Smith and requests withdrawal of the rejections under 35 U.S.C. § 102(b).

The new claims are directed to the features of a nuclear quadrupole resonance (NQR) apparatus for detecting a substance at an unknown temperature. The apparatus is operable to generate a pulse sequence that is a combination of two or more steady state free precession (SSFP) pulse sequences with phases alternating in a pattern to excite nuclear quadrupole nuclei in a frequency bandwidth that exceeds the frequency bandwidth covered by each of the SSFP pulse sequences individually. In this manner, intensity variations caused by an unknown substance temperature are minimized. The apparatus detects the resonance signal produced in

response, adds the spectral components, and shifts the phases in accordance with a predetermined order.

An example of this is described with reference to Figure 4. The specification at page 25, line 18 through page 26, line 4, describes four sequences of the SSFP type and page 26, lines 8-10, shows that the four sequences have different effective frequencies and therefore cover a larger part of the frequency spectrum, as described in the claim. After each pulse, the signal is acquired during an acquisition time (T_{acq}). All of the acquired signals are added together into one final signal, which is then analyzed. During a typical pulse sequence, there may be 3000 acquisitions and each of these signals are accumulated or added together to make the final signal.

In accordance with the present invention, T_{acq} is used to indicate where the signal is acquired during the pulse sequence. Each of the acquired signals from the plurality of SSFP sequences are added together to produce one final signal. As the different sequences have different effective carrier frequencies, when all of the acquisitions are accumulated after each pulse in the pulse sequences into one final signal, a larger part of the spectrum is effectively covered than if one of the sequences is used alone.

The problem with using conventional NQR for substance detection is that the NQR resonant frequency is dependent on the temperature and therefore when pulsing a sample which has unknown temperature (i.e. an explosive in a suitcase) it is impossible to know what the NQR frequency is. What is known is that it will occur somewhere within a small range. The present invention appreciates that at small periodic intervals away from the transmitter frequency the received NQR signal intensity drops. This is the temperature or intensity anomaly effect. In accordance with the apparatuses and methods of the present invention, an even NQR signal

intensity is produced regardless of the difference between the NQR resonant frequency and the transmitter frequency. This is important because it is desirable to receive a non-varying NQR signal so that explosives can be detected regardless of how much difference there is between the transmitter and NQR frequencies (since the temperature of the sample cannot be controlled and a robust pulse sequence is therefore needed to detect explosives under any conditions).

The pulse sequences disclosed by Smith are utilized for different reasons and under different conditions. The sequences of Smith are aimed at overcoming "spurious signals" (see col. 8, lines 53-64, and the background section of the disclosure of Smith) and are not specifically directed toward detection of a sample having an unknown temperature. These spurious signals such as magnetoacoustic ringing need to be subtracted out of the accumulated signal so that the underlying NQR signal can be analyzed. The present invention, on the other hand, discloses pulse sequences in order to overcome the temperature or intensity anomaly problem, which is unconnected to overcoming such spurious signals.

The temperature/intensity anomaly problem is caused by the temperature of the sample being unknown. This causes the NQR frequency to be unknown because the NQR frequencies are dependent on temperature. When pulsing a sample, the transmitter frequency is chosen close to the frequency line of the sample, but invariably they differ because the frequency line of the sample is not known. This results in a small frequency offset between the transmitter and the sample. If the wrong pulse sequence is being used, intensity anomalies will result. This means that the sample (e.g., an explosive) will be detected on some occasions but not others, which is obviously undesirable. If the SSFP sequences of the present invention are used then this problem is overcome and it will thereby be possible to detect an explosive regardless of the difference

between the transmitter frequency and the sample frequency. These features are not disclosed, taught, or suggested by Smith, which is instead directed to the minimization of spurious signals.

The new claims seek to define that the sequences in accordance with the present invention are directed to samples having an unknown temperature are therefore patentable over Smith for at least this reason.

In view of the foregoing all of the claims in this case are believed to be in condition for allowance. Should the Examiner have any questions or determine that any further action is desirable to place this application in even better condition for issue, the Examiner is encouraged to telephone applicants' undersigned representative at the number listed below.

PAUL, HASTINGS, JANOFSKY & WALKER LLP
875 15th Street, N.W.
Washington, D.C. 20005
Tel: 202/551-1700

Respectfully submitted,

Date: August 9, 2007 By: _____
Michael Bednarek
Registration No. 32,329

MB/SPA/GSS/ggb

Customer No. 36183